The Evolution of Network Slicing

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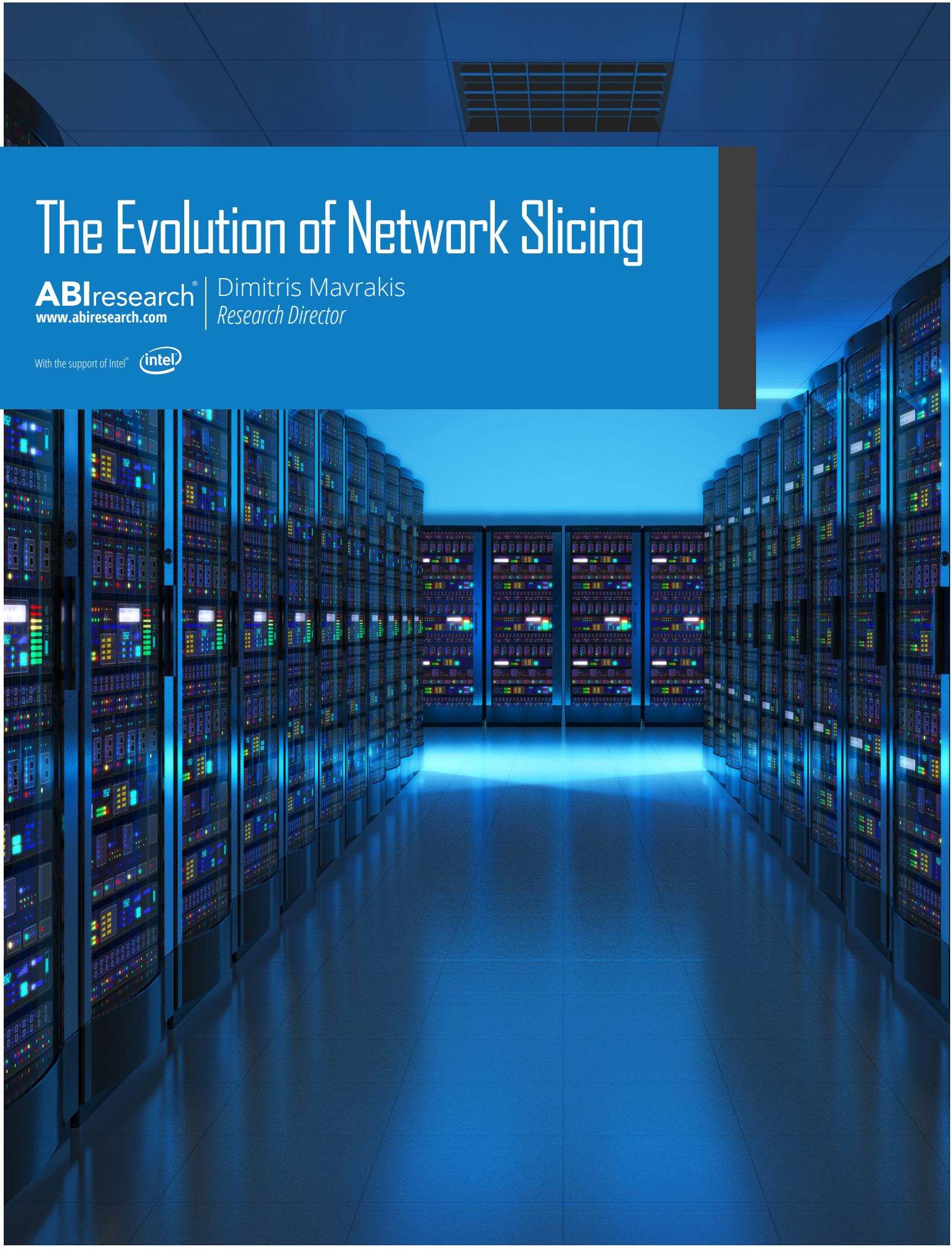
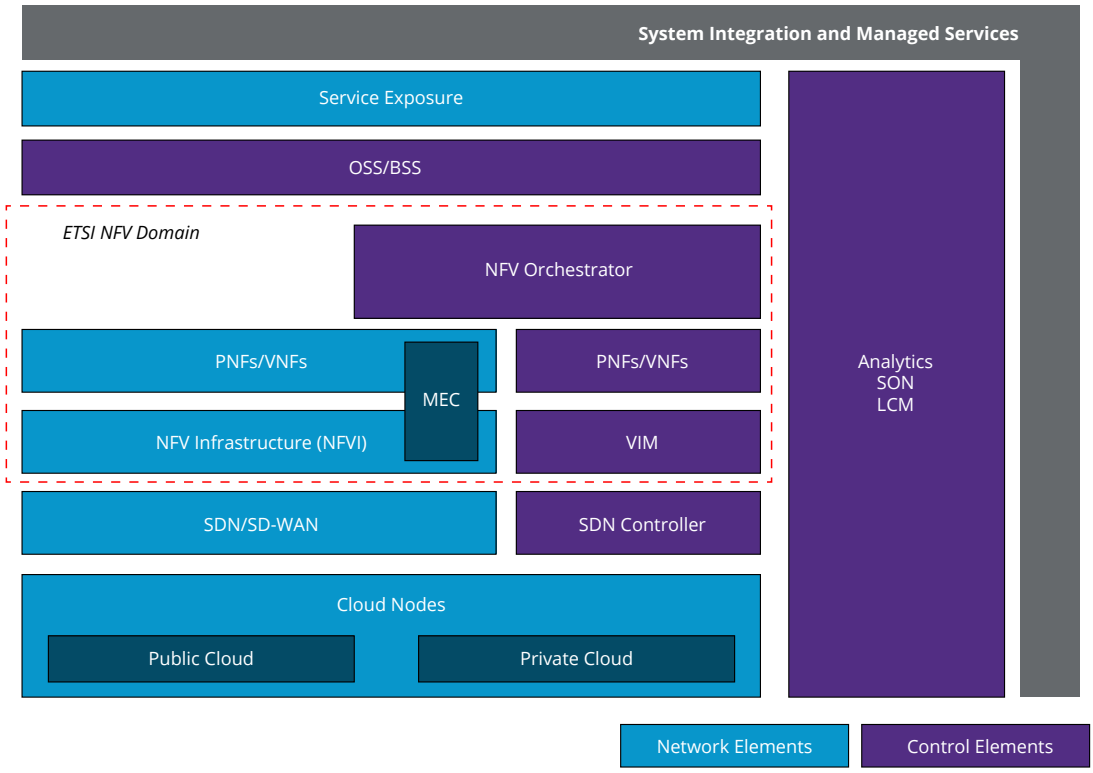


1. NETWORK SLICING MARKET DEVELOPMENT

The current telco market is facing a major evolutionary step, where software, cloud, and automated technologies are set to redefine the way telcos plan, deploy, maintain, and monetize their networks. It is also clear that telcos can no longer continue selling connectivity alone, although this will remain profitable in the long term. Telcos have access to the last mile, whether this is spectrum or a fixed connection and hold a vast amount of data for end users; these can be used for good: to predict major incidents, improve user experiences, proactively expect what a user will need, and much more. Connectivity is the foundation for these advanced services and telcos can evolve to be much more. The following diagram illustrates a telco cloud framework that will allow many of these advanced services.

Figure 1: Telco Cloud Framework

Source: ABI Research



Network slicing is being positioned as the cornerstone of advanced services, where telcos can sell tailored slices of network functionality to different types of end users—for example, bandwidth-heavy video or signaling-heavy sensor IoT applications.

1.1. DEPLOYMENT STATUS OF NETWORK SLICING

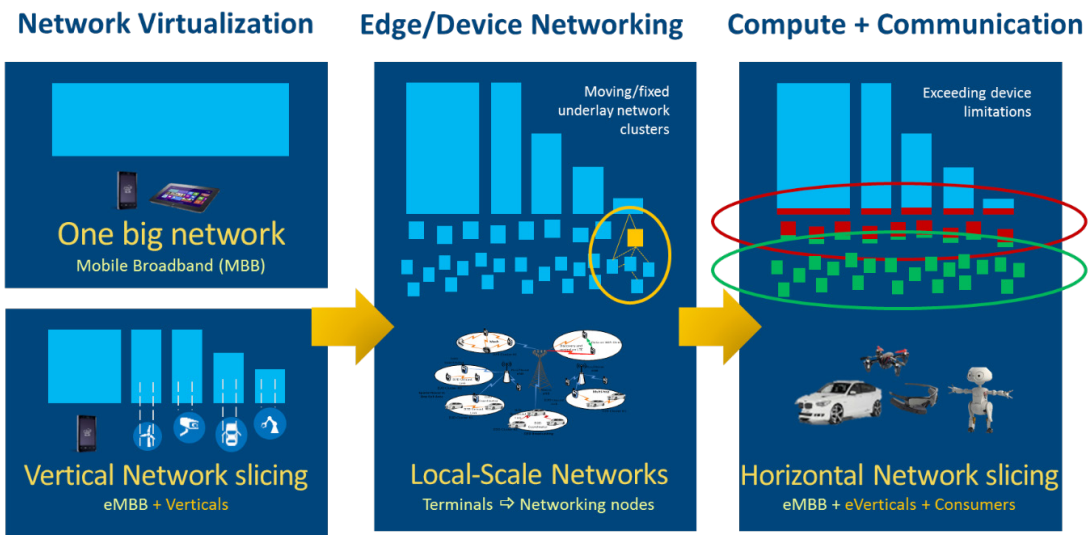
The market is currently trialing early network slicing use cases, mostly enabled by tightly integrated network equipment, rather than competing-vendor network elements. Although the market is in deep discussion for network slicing, the application of the concept in the commercial domain is still in an R&D and early

standardization phase. (A European project for the complete development of a network slicing framework started during 3Q 2017 and is expected to last 2 years; this project is called 5G-MoNArch. In China, FuTURE Forum has been working on a whitepaper on end-to-end network slicing since early 2017. In 3GPP, both RAN and SA working groups are looking into different technical aspects of network slicing for standardization). This is in line with telco abilities to monetize such advanced functionality, and in a way, the technical and commercial evolution of the network slicing concept needs to keep up for its successful mass market deployment. An early technical breakthrough could potentially find telcos unprepared to deploy these concepts commercially and for good reason: they have been accustomed to selling connectivity for decades and an immediate shift in business priorities would cause disruption.

In a few years, telcos will deploy the necessary infrastructure, OSS/BSS, 5G next-generation core, and supporting technologies to enable network slicing. At that point, the network will have already evolved to a distributed, carrier-grade telco cloud, where the core and the edge of the network will be running on common computing platforms, namely x86 servers. As with all new technologies, network slicing will evolve with time and expand its current application. Today telcos are slicing their mobile broadband networks vertically, with each slice serving a specific industry from end-to-end. In the future, telcos will be presented with the opportunity to take network slicing a step further and introduce horizontal slicing, where a networking node such as a mobile edge computing (MEC) server within a vertical slice can further slice its computing resource horizontally, and dedicate one of its slices for use by a mobile device connected through a high-data-rate and low-latency radio link such as 5G New Radio (NR). This horizontal slicing will augment the computing capability of a mobile device beyond its physical limitations, and create a new generation of moving underlay network, as shown in Figure 2.

Figure 2: The Evolution of Network Slicing from Vertical to Horizontal

Source: Intel



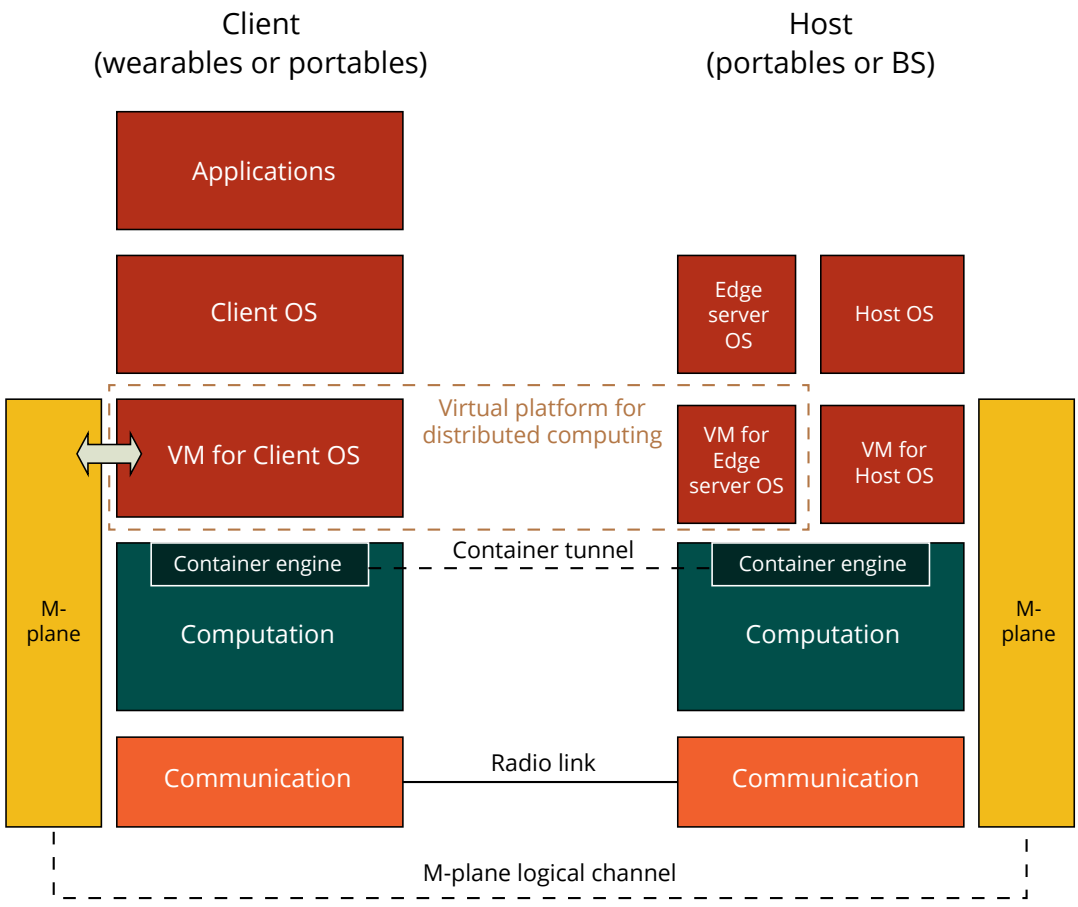
2. THE NEXT EVOLUTION OF NETWORK SLICING

In vertical network slicing, each network domain is partitioned in different slices according to the use case. These domain slices are then paired with slices from rest of the network to create a complete network slice. It should be noted that matching slice ingredients is not always proportional, since different applications will utilize different parts of the network according to their user or control plane payload.

In horizontal slicing, functionality is decoupled from the physical boundaries of the device itself, where computational, storage, and network functionality can be shared, even between infrastructure nodes and devices, and between devices. For example, a smartphone used by a professional in the health industry may use a vertical slice for healthcare (*e.g.*, for a low-latency, video tele-health application), a vertical slice for eMBB (for general Internet use), and at the same time, a horizontal slice for a wearable sensor, where the smartphone shares part of its processing capabilities with the lightweight wearable. Horizontal slicing achieves in the device what vertical slicing achieves in the network: it democratizes resources and, at the same time, wraps these resources in use case-specific slices. Figure 3 illustrates an example of horizontal slicing using a wearable and a smartphone.

Figure 3: Horizontal Slicing Example

Source: Intel



Horizontal slicing has many applications and brings several benefits to both consumer and enterprise communications. For example, it lessens the energy footprint of wearables and consumer devices, allowing the creation of smaller and more compact form factors. Moreover, it removes the need for in-device processing capabilities, which may in turn enable new form factors for many new types of applications. For example, augmented reality (AR) and virtual reality (VR) head-mounted displays (HMDs) are currently limited in terms of processing capabilities and most require a tethered connection to a more powerful device. In the future, a 5G network that allows vertical and horizontal slicing will be a true enabler:

- It will facilitate a network slice that brings low-latency and high-bandwidth communications for AR and VR
- Horizontal slicing will allow the smartphone (or similar end-user terminal) to share processing and storage capabilities with the HMD so the application is possible with an untethered connection

AR and VR are two examples where advanced network slicing can create new opportunities in adjacent markets that are not possible without telco involvement. Examples include automotive, healthcare, transport, logistics, and many more sectors. The ubiquity of processing capabilities is expected to create new opportunities in both telco and enterprise verticals. Although the industry is currently involved in the first phase of network slicing, certain aspects of horizontal slicing will need to be introduced in the discussion so that when the time comes, both types of slicing will be possible without redesigning parts of the first vertical slicing phase.

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